81340207

STUDIES OF ENVIRONMENTAL FATES OF DIMP AND DCPD

Monthly Progress Report 2

5 September 1978

By:

Ronald J. Spanggord, Ph.D.
Tsong-Wen Chou, Ph.D.
William R. Mabey, Ph.D.

Prepared for:

Commander
U.S. ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND
ATTN: SGRD-UBG
Fort Detrick
Frederick, Maryland 21701

Contract No. DAMD 17-78-C-8053
William Dennis, Project Officer

SRI Project LSU-7551

Approved by:

Peter Lim, Director
Pharmaceutical Analysis Laboratory

W. A. Skinner, Executive Director
Life Sciences Division

SRI International
333 Ravenswood Ave. • Menlo Park, California 94025
(415) 326-6200 • Cable: STANRES, Menlo Park • TWX: 910-373-1246

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	09/05/78	

4. TITLE AND SUBTITLE
STUDIES OF ENVIRONMENTAL FATES OF DIMP AND DCPD, MONTHLY PROGRESS REPORT 2

5. FUNDING NUMBERS
DAMD 17 78 C 8053

6. AUTHOR(S)
SPANGGORD, R.; CHOU, T.; MABEY, W.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
SRI INTERNATIONAL
MENLO PARK, CA

8. PERFORMING ORGANIZATION REPORT NUMBER
81340R07

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND
FORT DETRICK, FREDERICK, MD

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

THE OBJECTIVES OF THIS RESEARCH ARE TO CONDUCT LABORATORY EXPERIMENTS THAT WILL PREDICT THE PHOTOCHEMICAL AND BIOLOGICAL TRANSFORMATIONS OF DCPD AND DIMP IN THE SOILS AND WATERS OF ROCKY MOUNTAIN ARSENAL AND WILL PROVIDE A SEMIQUANTITATIVE EVALUATION OF DECOMPOSITION RATES OF, AND PRODUCTS RESULTING FROM DCPD AND DIMP. DURING AUGUST, SEDIMENT AND WATER SAMPLES WERE COLLECTED AT ROCKY MOUNTAIN ARSENAL, ANALYTICAL METHODS WERE INVESTIGATED FOR DCPD AND DIMP, UV ADSORPTION SPECTRA WERE MEASURED AND PRELIMINARY PHOTOCHEMICAL STUDIES WERE INITIATED, AND STUDIES WERE BEGUN TO OBTAIN ACCLIMATED MICROORGANISMS FOR DEGRADATION STUDIES.

14. SUBJECT TERMS
CONTAMINANTS, FAUNA, FLORA, SOIL, GROUNDWATER, CHEMICALS, BIODEGRADATION

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED			

INTRODUCTION

The U.S. Army Medical Bioengineering Research and Development Laboratory has the responsibility of developing environmental standards for pollutants that contaminate the environment at Army installations. Two such pollutants at the Rocky Mountain Arsenal are dicyclopentadiene (DCPD) and diisopropylmethylphosphonate (DIMP).

The objectives of this research are to conduct laboratory experiments that will predict the photochemical and biological transformations of DCPD and DIMP in the soils and waters of Rocky Mountain Arsenal and will provide a semiquantitative evaluation of decomposition rates of, and products resulting from DCPD and DIMP.

PROGRESS

During August, sediment and water samples were collected at Rocky Mountain Arsenal, analytical methods were investigated for DCPD and DIMP, uv absorption spectra were measured and preliminary photochemical studies were initiated, and studies were begun to obtain acclimated microorganisms for degradation studies.

Sample Collection

Water and sediment samples were collected from the North Bog at Rocky Mountain Arsenal as were various soil samples from areas of known DCPD and DIMP contamination. Samples were collected in presterilized glass bottles and bags and shipped by air to SRI where they were stored under refrigeration within less than 24 hours from sampling.

Analytical Chemistry

Methods were investigated to analyze DCPD by gas chromatography (gc) with flame ionization detection (FID). With standard solutions, 4 ng of DCPD could be analyzed readily on a 10% DC-200 at 85° isothermal. Naphthalene served as a good internal standard, with a response factor near 1.00. However, the isolation of DCPD from water and microbial solutions depends on extraction followed by a concentration step in which containing DCPD is difficult. We therefore have been investigating a purge-trap-desorption method to analyze for DCPD. Our preliminary investigations indicate that this method should be reliable to 2 ppb using 25-ml water samples and FID detection.

Sensitivity evaluations were also initiated for DIMP using an alkali flame ionization detector (AFID). Our preliminary estimates indicate that detection levels should be below 100 picograms. The chromatographic behavior of DIMP is best on a diethylene glycol adipate column where good peak shape is observed. Slight tailing is noted on nonpolar columns such as DC-200.

Photochemistry

The absorption spectra of both DIMP and DCPD were measured and were found to be very low in the solar spectral region (>290 nm). The molar extinction coefficient for DCPD was 2.0 M^{-1} cm^{-1} at 300 nm whereas a value of 0.2 M^{-1} cm^{-1} was found for DIMP at 300 nm.

We performed a preliminary photolysis experiment with 2 ppm DCPD in distilled water and in two RMA water samples, using a 450-watt mercury lamp filtered by the borosilicate immersion well. More than 70% of the initial DCPD was recovered after 5 days of photolysis in all samples. Part of the compound loss appears to be through volatilization and indications are that photolysis is not rapid.

Biodegradation

North Bog water samples and soils from the area were collected from Rocky Mountain Arsenal and transported to SRI and refrigerated.

Mixed cultures of microorganisms were obtained by inoculating mixed water samples or sterile water extracts of mixed soil samples into medium containing basal salts and glucose-plus-yeast extract; they were grown on a shaker at 25° C. These organisms were inoculated into the basal salt medium and glucose-plus-yeast extract medium containing 0, 2, 10, 20, 40 ppm DCPD or 0, 10, 20, 50, 100 ppm DIMP. Microbial growth was measured by the turbidities of the broths. DIMP did not inhibit the growth of water microbes even at the 100-ppm level. In contrast to our previous result with a local microbial mixture, DCPD did not inhibit the growth of RMA organisms at the 10-ppm level, but the growth of water and soil organisms at the 40-ppm level was lower.

The 3 liters of the top part of settled North Bog water, after being mixed with the sediment, was mixed with 1 liter of buffer solution in a 9-liter aeration bottle to begin microbial screening tests. DCPD was started with 3 and 10 ppm at pH 7.5 with 2 g/liter of phosphate buffer. Sterile water was used as control water. For studies with DIMP, tris buffer was used instead of phosphate buffer because organisms may use DIMP as phosphorus source to cause cleavage of C-P bond and the presence or orthophosphate may repress this metabolism.

DCPD was volatile and had to be supplemented during the incubation. Periodically, aliquots of bottle samples were withdrawn and inoculated into basal salts-DCPD or tris-basal salts, DIMP, or DIMP plus glucose media for observation of acclimated culture.

Acclimations were also conducted with nonbuffered and unaerated water samples with DCPD and DIMP. They were incubated both at 25° and 10° C.

FUTURE WORK

During September, culture acclimation and screening studies will continue, as will further development of analytical methods. Photochemical studies will be directed toward DIMP and the problem of volatilization in photochemical experiments.

Exhibit A is the performance schedule for project tasks and Exhibit B is a graphic representation of expenditures to date.

EXHIBIT A PERFORMANCE SCHEDULE FOR PROJECT TASKS

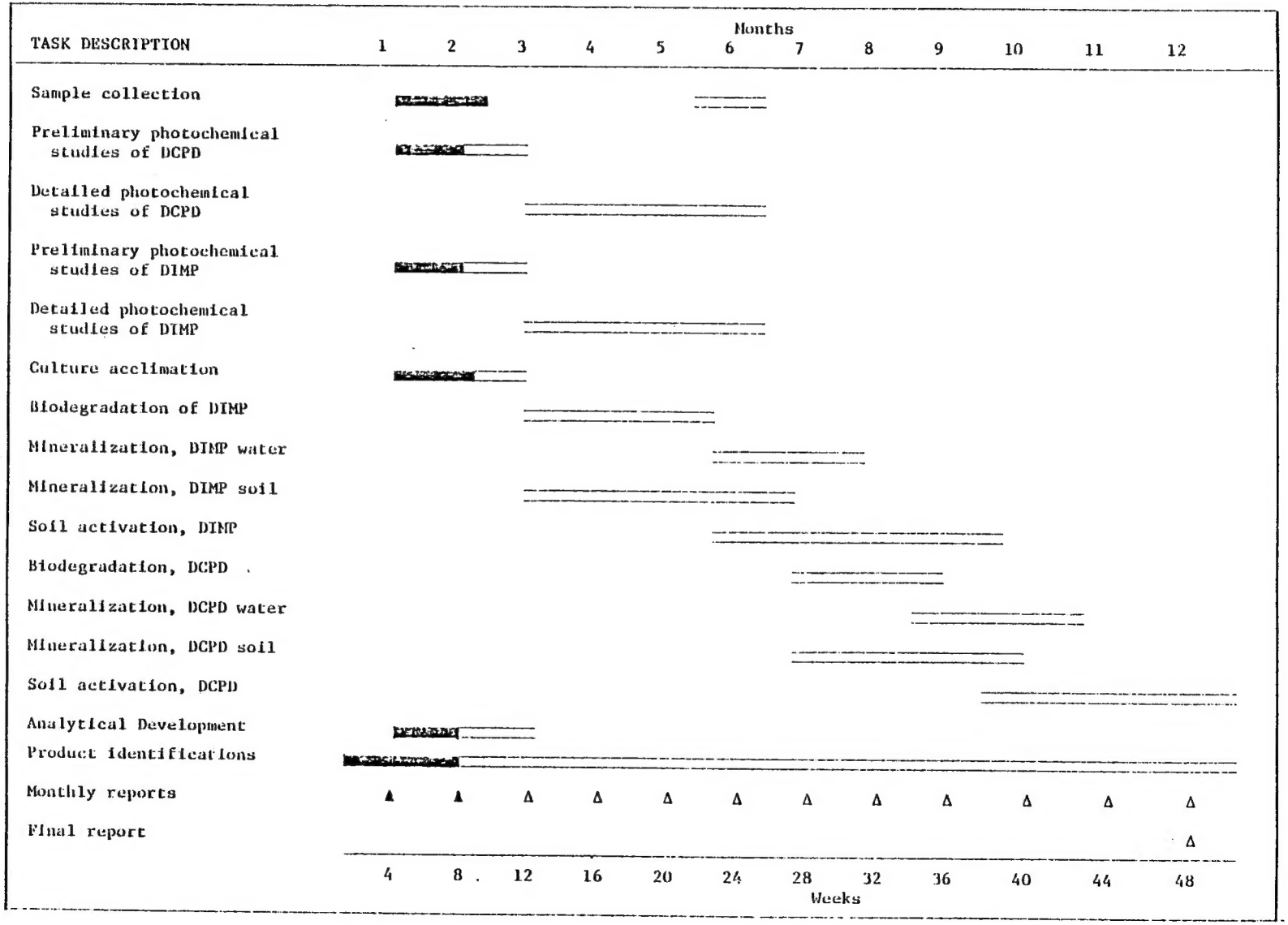

EXHIBIT B EXPENDITURES